MILWAUKEE EXPERIENCE WITH COMPOUND METERS[1]

By H. P. Bohmann[2]

Milwaukee's experience with compound meters dates from May, 1912, when the Meter Department installed, for service test, a 4-inch compound meter of a reliable make, on the service of the meter repair shop. This service is used solely for the testing apparatus and one hydraulic sidewalk lift. The stream flows on this line are from 3 inches to $\frac{1}{32}$-inch. On April 1, 1920, with a total registration of 3,455,022 cubic feet on the dial of the current section of the meter, and 689,652 cubic feet on the dial of the disc section, this meter was subjected to a weight test and the following results were obtained. On the 2-inch stream size (the largest permissible with present arrangement of testing apparatus) the current section meter showed an accuracy of 100.1 per cent and on the $\frac{3}{8}$-inch stream 96.6 per cent, while on the disc section operation the percentage of accuracy on the $\frac{1}{4}$-inch stream was 100.8, on the $\frac{1}{8}$-inch stream 99.2, on the $\frac{1}{16}$-inch stream 99.2, and on the $\frac{1}{32}$-inch stream 84.4.

In this meter there is a point of alternation or "change over" of stream flow through the current and disc section at about the $\frac{3}{8}$-inch stream. That is, at this point the valve is in a state of suspension or "leakage" and permits the diversion of a stream through each section too small for accurate registration on either. This condition, however, is not of very great concern, as it is not very probable that in actual service use the valve would remain in this suspended position for any period, due to the fluctuation of pressure and variation in consumption.

With a view to determining the relative accuracy of the compound type and the disc type of meters, a test was conducted for a period of one week by installing a 3-inch bronze case meter on the line in conjunction with the 4-inch compound, the compound meter being a sub-meter to the disc meter. The disc meter is one which

[1] Presented at the Montreal Convention, June 24, 1920. Discussion is invited and should be sent to the Editor.

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is used as a master meter in conducting field tests and is probably as accurate as any meter on the market of that type and size after some service. This meter previous to the installation showed an accuracy of 100.8 per cent on the 2-inch stream and 98.2 per cent and 85.6 per cent on the $\frac{1}{4}$-inch and $\frac{1}{8}$-inch streams respectively, while it failed to show registration on the $\frac{1}{16}$-inch. At the conclusion of the run the current section of the compound registered 5854 cubic feet and the disc section 2250 or a total compound registration of 8104 cubic feet, while the 3-inch disc meter registration was 6470 cubic feet or a loss through the 3-inch disc meter of 1634 cubic feet or about 20 per cent loss on registration for the week.

When one considers the inability of meters of the various types other than compound of the 3-inch and larger sizes to register the small stream flows, or their considerable inaccurate registration of those streams, the advantage of compound meter registration is very plain. Milwaukee has 515 meters of the larger sizes in the Worthington Piston, Rotary, Velocity and Disc types, 116 compound meters and 9 fire service meters. Notwithstanding the fact that these meters are subjected to annual field tests and held within the capability for registration for the size and type of the meter, one can't help wishing the entire large meter system were of the compound type.

During the past spring the department has, in its annual field tests, conducted tests of 76 compound meters in which the registration of the current section was 251,485,410 cubic feet and of the disc section 32,764,809 cubic feet, a total of 284,250,219 cubic feet. In most instances these meters were on new installations and a few replaced old worn piston and rotary type meters. It is rather hard to compare registration, but assuming these services were all controlled by disc meters, the most reliable accurate meter other than the compound type, and these disc meters were of the same accuracy as the 3-inch disc referred to in the shop test run, there would be a considerable loss in registration through failure to install compound meters.

A shop-test record of new meters of the velocity and compound type, which during the past 4 years have been presented for installation on the services, shows that while the various makes and sizes of velocity meters are accurate (2 per cent plus or minus) down to the $\frac{5}{8}$-inch stream size, the average accuracy of 22 3-inch to 6-inch meters of five meter companies below that stream size is as follows:

Stream, inches.....	½	⅜	¼	⅛	1/16
Accuracy, per cent.....	98.4	96.1	76.4	Fails to register	

On comparing these figures with the following record of 13 compound meters of three companies, it will be seen that there is considerable gain in registration by use of the compound.

Stream, inches.....	½	⅜	¼	⅛	1/16	1/32
Accuracy, per cent....	99.6	97.9	101	101.6	98.2	89.2

Some meter companies in an endeavor to overcome defective registration of the large section of the meter, have the operation of the valve regulated to "break" or "alternate" at a stream size of about ⅝ inch or ¾ inch and install a large disc meter to care for the smaller streams. Milwaukee experience has been that the best results are obtained in lowering the breaking or alternating point down to about the ⅜-inch stream for 3-inch and 4-inch meters and ½ inch for 6-inch meters. That is, have the operation of the current meter on these stream sizes, and the disc section on the lower streams, and the use of a disc meter not larger than 1-inch for 3-inch, 4-inch or 6-inch compound meters.

The reason for this is very plain. The purpose of a compound meter is to secure as far as possible registration of the small streams without sacrificing the maximum delivery, and it is well known that meters of the ⅝-inch, ¾-inch or 1-inch size will register more closely than a 1½-inch or 2-inch meter. With the exception of stoppage of registration on some meters by sand, which is apt to occur to a disc meter, very little trouble has been experienced with compound meters. The upkeep of these meters is very little, being confined to small items of disc section repairs or gear trains and bushings in the current section. On the whole, Milwaukee is well satisfied that a goodly portion of the "unaccounted supply" can be accounted for by the use of compound meters on services where the flow is intermittent, or even in premises supposedly using "large flows at all times."